fested in biochemical processes one can not refrain from contrasting, with Arrhenius, the explanation of the Ehrlich phenomenon on the basis of the law of mass action and that based on the assumption of multitudinous "partial poisons," toxins and toxoids, forming a characteristic if somewhat unintelligible "poison spectrum."

The book should operate as a stimulus and a spur. From personal contact the writer has reaped no small benefit and much inspiration in other branches of the scientific field. Could this volume attract the attention of some young student in the field of biochemical labors and induce in him the determination to go to the source and obtain personally the fruits of ripened thought and mature judgment progress would surely result. In the present pages there is manifest the characteristic genius of the author with his clarity of presentation of the particular thesis in hand. A few infelicities of English occasionally mar the text and suggest that perhaps the assistance of the English editor might have been a little more generously given. Words such as "inanimated" and "stomachical" might readily have been replaced.

HUGH S. TAYLOR

PRINCETON, N. J.

The Physiology of the Amino Acids. By FRANK P. UNDERHILL, Ph.D. Yale University Press. 1915. Pp. 169. Price $1.35.

It is truly symptomatic of modern scientific development that books should be written which divide physiology into physical and chemical portions, and that following this classification still finer divisions are introduced. One of these latter subdivisions is treated for the first time as an entity in Underhill's delightful little book, "The Physiology of the Amino Acids." Each known amino acid is enumerated and its discoverer given. Then follow those details which have thus far been unravelled regarding the intimate life history within the organism of the behavior of the structural units which compose the protein molecule. From the descriptions given in this book the reader may readily grasp the processes of synthesis and analysis, of oxidation and of reduction through the interplay of which protein under given conditions may be resolved into carbonic acid and urea, and under other conditions, into the texture of the living cells. For emphasis of the latter destiny Osborne and Mendel's experiments on the growth of rats form a fitting descriptive material. The book will be of interest and value to biologists in general and to physicians who have not forgotten their chemistry.

GRAHAM LUSK

SPECIAL ARTICLES

THE DISCOVERY OF THE CHESTNUT-BLIGHT PARASITE (ENDOTHIA PARASITICA) AND OTHER CHESTNUT FUNGI IN JAPAN

To Mr. Frank N. Meyer, agricultural explorer of the office of foreign seed and plant introduction of the Department of Agriculture, belongs the distinction of having discovered the chestnut-blight fungus (*Endothia parasitica*) in Japan as well as in China.[1, 2]

Meyer's discovery of the fungus in China has been accepted as proof of the oriental origin of this parasite which has proven so destructive to the chestnut in the northeastern United States and is rapidly spreading southward. Its discovery in Japan furnishes additional evidence as to the correctness of Metcalf's[3] hypothesis that the parasite was introduced into this country from Japan.

Meyer's discovery of *Endothia parasitica* in China made the presence of the same fungus in Japan seem extremely probable. And later, during her visit to this country in the fall of 1914, Dr. Johanna Westerdijk informed the writers that while in Japan she had seen at

[1] Fairchild, David, "The Discovery of the Chestnut-bark Disease in China," SCIENCE, N. S., Vol. 38, No. 974, pp. 297–299, August 29, 1913.

[2] Shear, C. L., and Stevens, Neil E., "The Chestnut-blight Parasite (*Endothia parasitica*) from China," SCIENCE, N. S., Vol. 38, No. 974, pp. 295–297, August 29, 1913.

[3] Metcalf, Haven, "The Immunity of the Japanese Chestnut to the Bark Disease," Bur. Plant Ind., U. S. Dept. Agr. Bull. 121, Pt. 6, 1908.

Nikko and other places chestnut trees affected by a fungus which appeared identical with *Endothia parasitica* in this country. Miss Westerdijk also stated that she had collected specimens of the fungus but these specimens with many of her other collections were lost at sea.

Following this the writers endeavored to obtain specimens of the chestnut-blight parasite by correspondence. Among those to whom the request was sent was Mr. H. Loomis, of Yokohama, who very kindly interested himself in the matter, and on February 18 wrote as follows:

> In compliance with your request of January 4 I have communicated with Professor Y. Kozai, of the Imperial Agricultural Station, Nishigahara, Tokyo, and he writes that "The chestnut blight is found to some extent in the Provinces of Tamba, Ise, Suruga and Shimotsuke (Nikko is in the latter). This disease is limited to the seedlings in the nursery and the young trees (three or four years old) in the field and may be prevented by spraying with Bordeaux mixture."
>
> I have requested him to procure specimens of the fungus and send the same to you directly. I hope this will meet your desire. . . .

Soon after this a packet of three specimens of fungi on chestnut bark was received from Professor Y. Kozai with a letter stating that they were "specimens of the Japanese chestnut canker." None of these proved to be *Endothia parasitica,* but one specimen collected October 14, 1915, in the province of Totomi by S. Tsuruta, and labeled "Cancer on chestnut," was evidently an *Endothia,* which after careful study of stromata, pycnospores and cultures on various media the writers are convinced is identical with the oval-spored species of *Endothia* found both in this country and in Europe and referred to in their earlier paper[4] as *Endothia radicalis* (Schw.) De Not. The other two specimens sent by Professor Kozai showed no *Endothia* but two other Pyrenomycetes.

[4] Shear, C. L., and Stevens, Neil E., "Cultural Characters of the Chestnut-blight Fungus and Its Near Relatives," Circ. No. 131, B. P. I., Dept. Agr., July 5, 1913.

Shortly before the specimens above referred to were received from Japan a number of specimens of Japanese chestnut from California were turned over to the writers for study. These were part of a shipment from the Yokohama Nursery Co., Yokohama, Japan, consigned to the Sunset Nursery, Oakland, Cal., which were condemned in February, 1915, by Frederick Maskew, chief deputy quarantine officer, San Francisco, Cal., upon recommendation of Dr. E. P. Meinecke, forest pathologist, U. S. Department of Agriculture, stationed in that city. In his letter recommending the destruction of this nursery stock Dr. Meinecke called attention to the presence of a fungus apparently parasitic which "in the absence of other fruiting forms must be classed with the fungi imperfecti (*Cytospora* species.)" Of 100 plants examined Dr. Meinecke found 43 infected with this fungus. A number of the infected trees were turned over to the writers by the Federal Horticultural Board and bear their plant disease survey number 264.

The writers have had the fungus referred to by Dr. Meinecke in culture since early in April, 1915, and have made inoculations on the native American chestnut (*Castanea dentata*) but thus far have been unable to obtain ascospores or any evidence of parasitism on *Castanea dentata.*

In addition to this fungus two of the Japanese seedlings received from California showed a few tiny, yellow ochre pycnidial stromata, smaller than but closely resembling in form and color those of *Endothia radicalis.* A careful study of the pycnidia, pycnospores and cultures of this fungus on various media has convinced the writers that this also is a species of *Endothia* having quite different cultural characters from any species yet known.

Mr. Walter T. Swingle during his recent visit to Japan obtained a small portion of a specimen which was exhibited as chestnut-blight. This specimen which was given him by Dr. Nishida is not an *Endothia,* but so far as can be determined from cultures appears to be identical with the imperfect fungus found on the Japanese chestnuts condemned at San Francisco in February, 1915.

From a study of these few specimens it is evident that there are in Japan several Pyrenomycetes including species of *Endothia* more or less parasitic on chestnut. This fact may help to explain the failure of Japanese pathologists to distinguish the true chestnut blight caused by *Endothia parasitica*. Dr. Gentaro Yamada on his recent visit, July, 1915, to this country, informed the writers that the numerous publications concerning the chestnut-blight in the United States had naturally aroused the interests of Japanese pathologists but that so far they had been unable to find any parasitic *Endothia*. This is further verified by a paper in Japanese[5] by Kanesuke Hara, an abstract of which has been kindly furnished us by Dr. T. Tanaka. Hara considers that *Endothia gyrosa* (Schw.) Fuck. must be identical with *E. parasitica* (Murr.) A. & A. He describes a species of *Endothia* found on a dead twig of *Quercus glandulifera* Bl., which he regards as *Endothia gyrosa*. This report indicates that species of *Endothia* occur in Japan upon *Quercus* as well as on *Castanea*. We have just received pycnidia of an *Endothia* on chestnut from Mt. Hara labelled *E. gyroza?* which in culture appears different from any species yet cultured by the writers.

Having failed to obtain a specimen of *Endothia parasitica* by correspondence and learning that Mr. Meyer was to visit Japan on his return from China, the writers requested Mr. David Fairchild, agricultural explorer in charge of foreign seed and plant introduction, to send a cablegram asking him to look for the chestnut blight in the vicinity of Nikko. Meyer's observations in Japan are best given by quotations from his letters:

Sept. 17. Frid. In Nikko . . . found plenty of evidences of the chestnut-blight, especially on the higher, more exposed parts of the mountains; collected a large bundle of material, took several fotos. . . .[6]

Sund. Sept. 19. In Yokohama; . . . inspected grafted and budded nursery stock, especially chestnuts and cherries, found them exceptionally clean. No signs of *Diaporthe parasitica* on chestnut seedling and grafted stock, although the wild trees of *Castanea japonica* on the hills surrounding the nurseries are infested with the blight.

Mond. Sept. 20. In Yokohama; . . . The chestnut-blight, *Diaporthe parasitica*, is quite common in Japan, that is at least around Nikko, Tokyo and Yokohama. Wild as well as cultivated trees are attacked, though the disease, as a whole, is not very destructive. Trees vary considerably as regards powers of resistancy and on the lower slopes of hills around the Kanaya Hotel at Nikko, trees were found that were large and vigorous and apparently immune, while on the higher mountains and more exposed parts trees were found that were badly attacked. This Japanese chestnut, *Castanea japonica* might be used as a factor in hybridization experiments, together with American, European and Chinese species to create immune or nearly immune strains of chestnuts.

Meyer further states to the writers that the Japanese chestnut, *Castanea crenata* Sieb. & Zucc., is even more resistant to *Endothia parasitica* than is the Chinese chestnut, *Castanea mollissima*. This further emphasizes the difficulty of locating *E. parasitica* on chestnut in Japan where as already stated several other fungi are common.

On the arrival of Meyer in Washington he gave the writers specimens of diseased chestnut branches collected at Yokohama and at Nikko. On the material from Yokohama no *Endothia* was found. Specimens from Nikko which were more abundant showed cankers and mycelial fans typical of *Endothia parasitica* and numerous stromata of the fungus. Some of these stromata contained mature ascospores and many of them viable pycnospores and ascospores. Cultures were at once made on cornmeal in flasks and on cornmeal and potato agar. These cultures proved identical with cultures made at the same time from typical *E. parasitica* collected in this country and also with the Chinese material which has been kept in pure culture. While the season of the year makes inoculations impossible the mycelial and spore characters of this fungus

[5] Hara, Kanesuke, "Further Discussion Must be Needed on the Problem of the Chestnut-blight Disease, 'Byôchû-gai Zassi'" (*Journal of Plant Protection*), Vol. 2, No. 3, March, 1915, pp. 242–245 (Japanese).

[6] Some of the pictures of blighted chestnuts taken by Meyer at Nikko will be published later.

as well as its cultural characters are so distinctive as to leave no doubt as to its identity. The fungus collected by Meyer at Nikko is unquestionably *Endothia parasitica.*

The above statement was completed and submitted for publication December 23, 1915. During the interval following, several specimens of fungi from Japan have been received by the writers which are of such interest in connection with the observations recorded above that it seems desirable to add them. On December 27, 1915, there was received from the Federal Horticultural Board a specimen of diseased chestnut nursery stock (their number 947), which had been sent by H. M. Williamson, secretary of the State Board of Horticulture at Portland, Oregon.

In the letter transmitting the specimen Mr. Williamson states that it was from

> an importation of nursery stock . . . grown at Kanagawa-Ken, Yokohama, Japan. . . . Included in this shipment were some chestnut trees and five of the chestnut trees were diseased. . . . Four of the chestnut trees have been burned and I am mailing you the other diseased tree under separate cover.

The fungus, which showed only pycnidia, has been cultured and is apparently the same as that found on the chestnut seedlings condemned at San Francisco in February, 1915, and mentioned above, and which was also found on the specimen brought from Japan by Swingle.

A small specimen of an *Endothia* collected at Nikko, Japan, September 17, 1915, on bark of *Pasania* sp. (*Quercus* of some authors), has been recently transmitted to the writers by Mr. Frank N. Meyer. This specimen shows typical ascospores of *Endothia radicalis* (Schw.) and in cultures proved identical with those of *Endothia radicalis* collected in this country. This collection seems to leave no doubt that *E. radicalis* is indigenous in Japan and that there as in Europe and America it is not confined to *Castanea.*

January 8, 1916, the writers received from Dr. Gentaro Yamada, of the Morioka Imperial College of Agriculture and Forestry, two specimens, one labeled "on *Quercus crispula.* Mt. Moriva, near Sapporo, Hokkaido, Japan. March 27, 1897. Coll. G. Yamada & T. Totsu," the other labeled "*Endothia parasitica* on *Castanea vulgaris* Lam. var. japonica DC. Morioka, northern Japan. Dec. 5, 1915. Coll. G. Yamada." The fungus on *Quercus crispula* was of course no longer viable. It contained, however, abundant ascospores which agree in their measurements with those of *Endothia radicalis.*

The specimen on *Castanea* is typical *Endothia parasitica,* as shown by the mycelial fans, pycnospores and ascospores, and by cultures. This specimen shows hypertrophy of the tissues very similar to that produced by the fungus on American chestnuts. In the letter accompanying this specimen, dated December 15, 1915, Dr. Yamada says he found the specimen of *E. parasitica* on his first collecting trip after his return to Japan. In this connection it may be stated that during his recent visit to this country Dr. Yamada spent some time with the writers in examining specimens of *Endothia parasitica* and other species of *Endothia* and took back with him typical specimens. This probably accounts for his finding the fungus so quickly.

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THE AMERICAN SOCIETY OF ZOOLOGISTS. II

GENETICS

Sex Controlled in Rotifers by Food (illustrated by lantern): D. D. Whitney, Wesleyan University.

Several species from two of the five orders of rotifers have yielded very positive results. All female offspring were produced under certain food conditions and from 30 per cent. to 95 per cent. male offspring were produced under certain other food conditions. In some of the species the offspring were all females when the race was fed upon a diet of colorless flagellates, but when the race was suddenly put upon a diet of green flagellates a high percentage of male offspring appeared. In other species a scanty diet of green flagellates produced all female offspring while a